ATTACHMENT 17
ECOLOGICAL RISK ASSESSMENT FOR OB/OD

2. SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

The following screening level ecological risk assessment (SLERA) supports a permit application under Subpart X of the Resource Conservation and Recovery Act (RCRA) for the open burn and open detonation (OB/OD) unit at Tooele Army Depot (TEAD) in Tooele, Utah. Ecological risk assessment (ERA) is a process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors. An ERA is similar to a human health risk assessment except that it addresses effects on ecological receptors such as plants, wildlife, and aquatic biota rather on than humans and domesticated plants and animals. The SLERA follows a protocol developed specifically for hazardous waste combustion facilities by the U.S. Environmental Protection Agency (EPA) Office of Solid Waste (U.S. EPA, August 1999). The stressors considered in SLERA are chemical substances potentially emitted by operation of the OB/OD Unit.

A SLERA is an initial stage in the ERA process that relies primarily on published data and simplifying assumptions to estimate the potential risk from a large number of chemical substances potentially emitted from a hazardous waste combustion facility. The EPA SLERA protocol for hazardous waste combustion facilities (U.S. EPA, August 1999) encourages the use of reasonable, not theoretical worst-case, assumptions when evaluating potential risk in a SLERA. It also encourages use of site-specific data in lieu of simplifying assumptions whenever the data is available. If the SLERA indicates that additional site-specific data must be collected to evaluate the potential risk from certain chemical substances, then those substances can be retained as chemicals of potential ecological concern (COPECs) and evaluated in a subsequent Phase II ERA.

The U.S. Army Environmental Center (AEC) completed a sitewide ERA for TEAD in 1997 (U.S. Army, May 1997). The sitewide ERA evaluated potential ecological risks associated with 56 solid waste management units (SWMUs) and two areas of concern (AOCs) identified on TEAD under RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). One of the SWMUs evaluated in the sitewide ERA is SWMU 1, the Main Demolition Area, which is the area containing the OB/OD Unit. The SLERA is independent of the sitewide ERA. The assessment of SWMU 1 in the sitewide ERA was based on soil samples collected in the immediate vicinity of the OB/OD Unit and served to evaluate the ecological impact resulting from contamination originating from past operations in the area. In contrast, the SLERA is based on estimated contamination levels based on emissions from operation of the OB/OD Unit. The SLERA serves to evaluate the ecological impact resulting from continued operation of the OB/OD Unit.

2.1 PROBLEM FORMULATION

Problem formulation establishes the exposure setting used as the basis for exposure analysis and risk characterization. It typically includes (1) characterization of the exposure setting, including identification of the ecological habitats that are potentially exposed; (2) development of food webs representative of the habitats being evaluated; (3) selection of assessment endpoints; and (4) identification of measurement endpoints (U.S. EPA, August 1999). Habitats in the vicinity of TEAD are broadly described in Section 2.1.1. Habitats at specific locations evaluated in the SLERA are described in Section 2.1.2. A conceptual site model illustrating food webs and potential exposure pathways is discussed in Section 2.1.3. Assessment endpoints are addressed in Section 2.1.4, and measurement endpoints identified for the ERA are discussed in Section 2.1.5.

2.1.1 Regional Ecological Description

The following description is summarized from data in the site-wide ERA (AEC, 1997). TEAD is located in a region classified as cold semi-desert, characterized by sagebrush and saltbush. Plants must be capable of surviving low precipitation and high evaporation rates as well as alkaline and saline soils. Ecological habitats on TEAD consist of areas supporting disturbed sagebrush vegetation intermixed with areas of grassland and a few localized riparian/wetland habitats. Cattle grazing is currently permitted on TEAD, and grazing has substantially influenced vegetation throughout much of the installation.

An ephemeral stream, Box Elder Wash, traverses the area containing the OB/OD Unit. Box Elder Wash flows only after heavy rain or when rapidly melting snowpacks in mountains west of TEAD contribute large volumes of runoff to the upper reach of the stream. For purposes of the SLERA, Box Elder Wash will be analyzed as a terrestrial rather than aquatic habitat.

The region containing TEAD is inhabited by a variety of invertebrates, birds, mammals, reptiles, and amphibians. Common invertebrates include grasshoppers, beetles, butterflies and moths, ants, spiders, and the Mormon cricket. Outbreaks of Mormon crickets and various grasshopper species are not uncommon. Among birds, raptors such as eagles, hawks, falcons, and owls occur frequently because of the abundance of small mammals that serve as prey. Few other bird species favor the region. Common large mammals include the mule deer, pronghorn antelope, and coyote. Coyote populations tend to vary cyclically in response to the populations of jackrabbits, which are their preferred prey. When jackrabbit populations are low, the coyotes subsist on small rodents, which are plentiful most of the time.

Among reptiles, snakes and lizards are common throughout the region. Amphibians are generally scarce due to the limited occurrence of water. The Great Basin spadefoot toad is supported by temporary bodies of water that form following infrequent rainfalls, as are occasional salamanders.

2.1.2 Locations Selected for Evaluation

Five locations have been selected for quantitative analysis of potential ecological risk in the SLERA, as follows:

Location 1: The location on TEAD with the highest estimated exposure to emissions from the OB/OD Unit (Maximum On-site Concentration Site)

Location 2: The location off of TEAD with the highest estimated exposure to emissions from the OB/OD Unit (Maximum Off-site Concentration Site)

Location 3: Box Elder Wash

Location 4: Grantsville Reservoir

Location 5: Rush Lake.

Locations 1 and 3 are on TEAD and Locations 2, 4, and 5 are areas off of TEAD but still potentially influenced by emissions from the OB/OD Unit. Figure 2.1.2-1 depicts the OB/OD Unit, Box Elder Wash (Location 3), and lines corresponding to the locations of maximum on-site and maximum off-site concentrations (Locations 1 and 2). Locations 1 and 2 are actually lines rather than point locations, and all points on each line are considered to be equally contaminated. Figure 2.1.2-2 depicts the locations of Grantsville Reservoir (Location 4) and Rush Lake (Location 5).

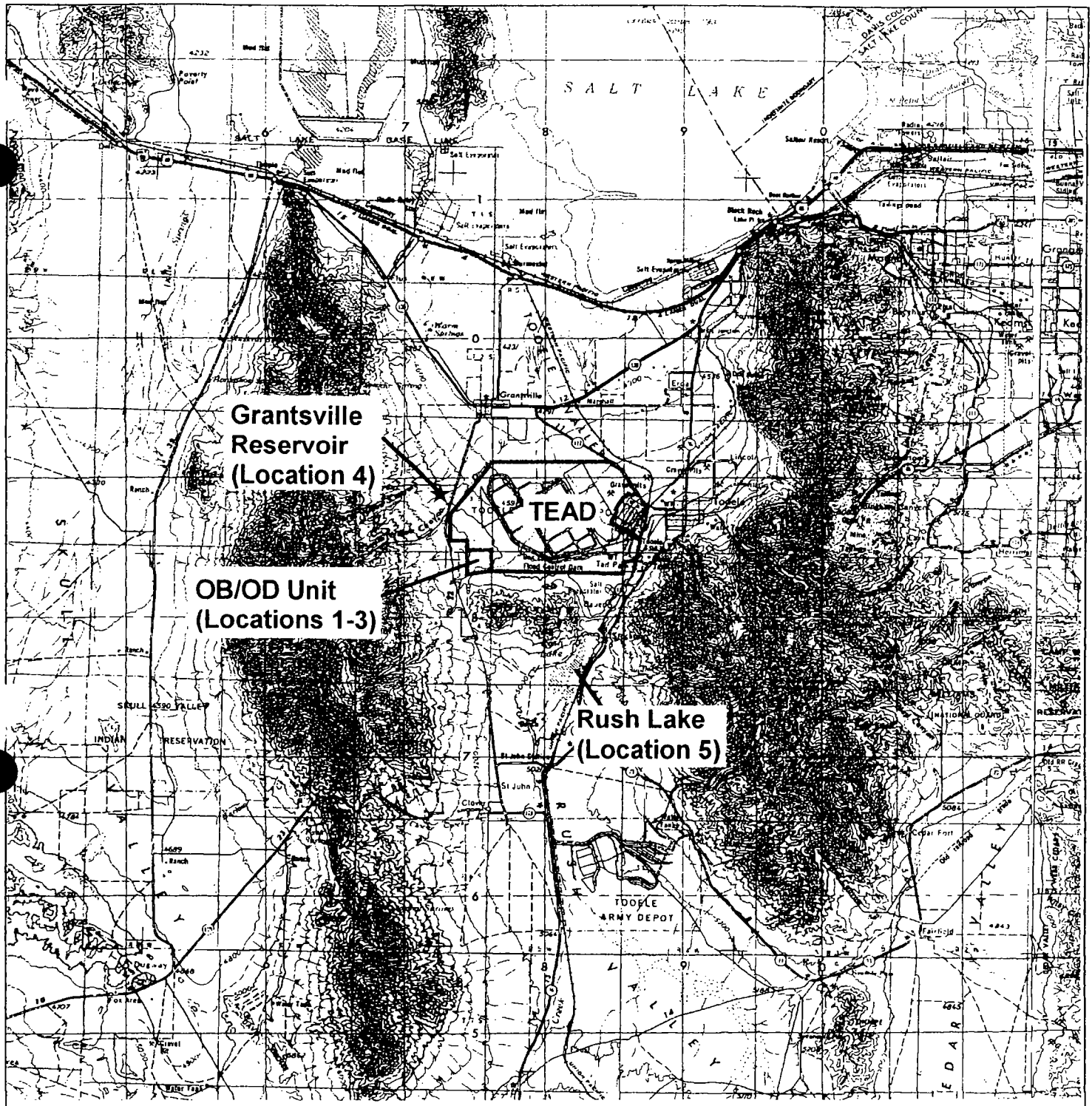

Figure 2.1.2-1

Potential Ecological Exposure Locations Evaluated

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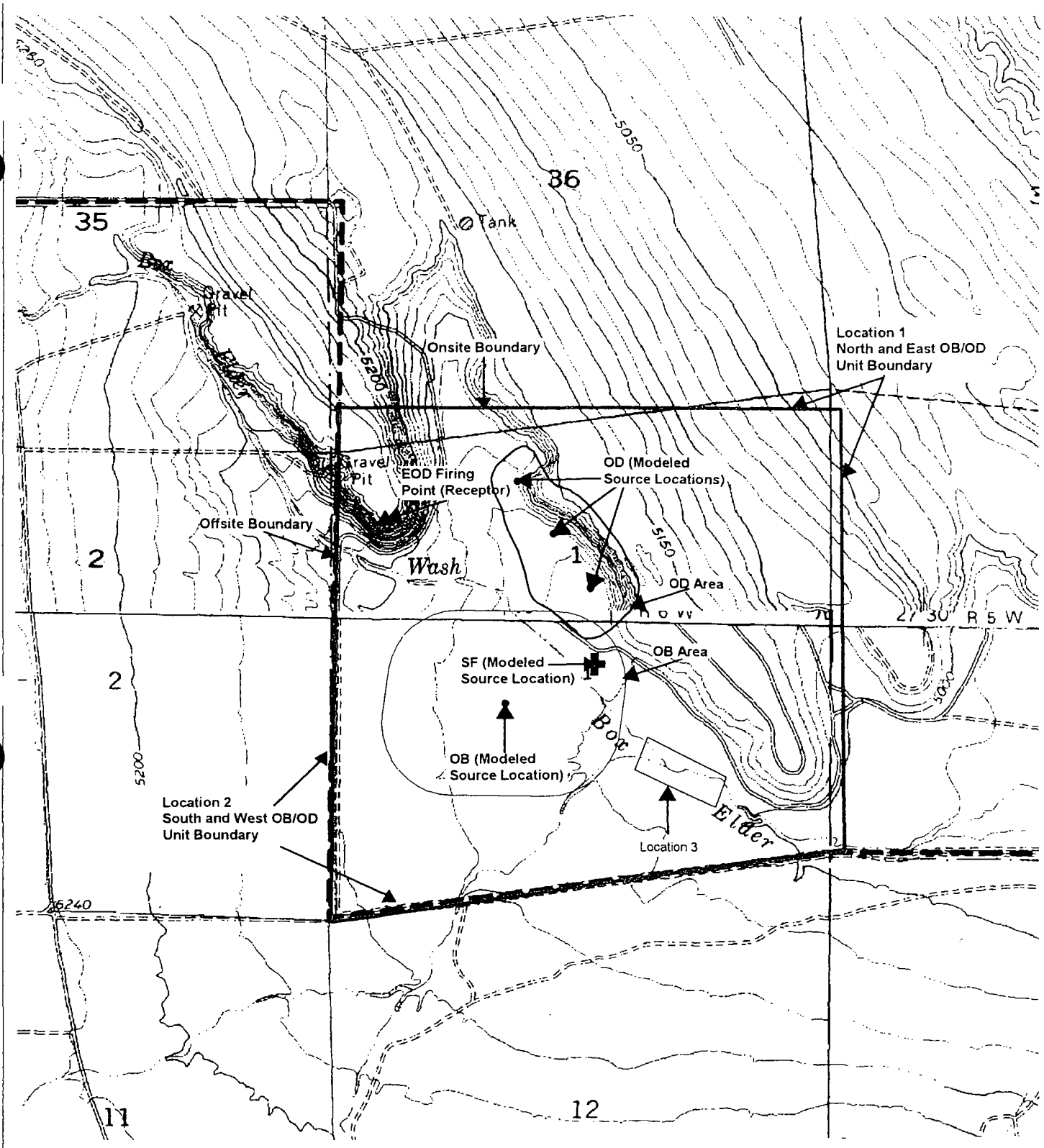

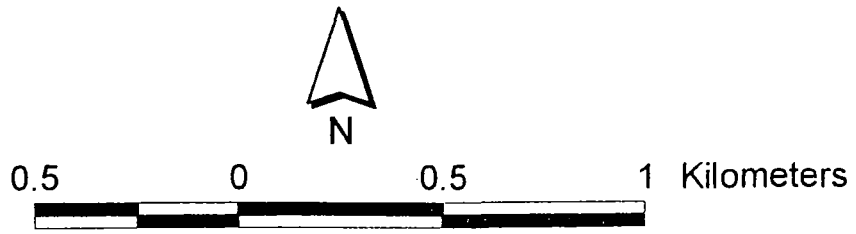

Figure 2.1.2-2

TEAD OB/OD Unit Source and Receptor Locations

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Locations 1 and 2 are selected for evaluation because they represent the areas subject to the highest potential concentrations of chemical contaminants derived from emissions released by OB/OD operations. Locations 3, 4, and 5 are selected because they contain ecologically sensitive riparian and aquatic habitats.

Locations 1 and 2 support the annual grassland and disturbed sagebrush habitats that are typical throughout the landscape in the vicinity of TEAD. Box Elder Wash (Location 3) is a narrow riparian zone associated with an ephemeral stream channel that is typical of the few widely scattered riparian habitats in the vicinity of TEAD. It is located in close proximity to the OB/OD Unit.

Grantsville Reservoir is a manmade reservoir that is roughly square in shape with a surface area of approximately 4 acres and a maximum depth of approximately 39 feet. It is located approximately 1 mile west of TEAD and serves as a source of irrigation water. Water is diverted into the reservoir from an upstream reach of Box Elder Wash and from other stream channels that flow down the mountains on the west side of the Tooele Valley. The shorelines are abrupt, and there is at most a very narrow fringe of emergent wetlands bordering the open waters of the reservoir.

Rush Lake is a natural lake that is irregular in shape with a surface area of approximately 3,000 acres (variable) and a maximum depth of approximately 5 feet (variable). It is located approximately 3 miles south of TEAD. Portions of Rush Lake dry out during periods without rainfall. Rush Lake lacks an outlet and displays some properties typical of a Great Basin playa. Great Basin playas are areas that accumulate surface runoff and inflow from streams but that lack a surface outlet. Incoming water accumulates during infrequent rainfall events and then evaporates, exposing a salt-encrusted soil surface (Trimble, 1989).

For purposes of the SLERA, Locations 1, 2, and 3 will be assumed to be naturally vegetated upland habitats lacking surface water. Although Box Elder Wash supports brief periods of surface flow immediately following heavy rainfalls, it is dry for the vast majority of the year. Locations 4 and 5 (Rush Lake and Grantsville Reservoir) will be assumed to be aquatic habitats capable of supporting emergent and/or submerged vegetation, benthic macroinvertebrates, and small fish. However, the fact that Rush Lake may periodically dry out and may contain hypersaline water could preclude or limit the occurrence of most aquatic biota.

2.1.3 Exposure Pathways and Conceptual Site Model

Stressors: The stressors considered in the SLERA consist of chemical constituents derived from operation of the OB/OD Unit. The OB/OD operation releases chemical constituents into the air, where the constituents can be carried over the surrounding landscape and deposited onto the soil surface. Contaminated soil can be resuspended by the wind as fugitive dust, which can then be redeposited elsewhere on the landscape. Rainfall can also cause contaminated soil to become suspended as sediment in surface runoff. Surface runoff tends to carry the contaminated sediment into streams and other waterways.

Receptors: The receptors considered in the SLERA consist of plants and animals other than crops and domesticated livestock. For terrestrial plants, aquatic plants, soil invertebrates, benthic invertebrates, and fish, the SLERA considers potential impacts to the overall communities present at each affected location. For terrestrial wildlife, the SLERA considers separately specific functional feeding guilds for mammals and birds. The functional feeding guilds include herbivorous mammals and birds that feed exclusively or predominantly on plants, carnivorous mammals and birds that feed exclusively or

predominantly on other animals, and omnivorous mammals and birds that feed on plants as well as on invertebrates and other animals.

Pathways: Table 2.1.3-1 is a conceptual site model illustrating pathways by which the receptors discussed above may be exposed to chemical constituents derived from operation of the OB/OD Unit. A complete exposure pathway consists of (1) a source of contaminants that can be released to the environment, (2) a route of contaminant transport to an environmental medium, and (3) a mechanism by which a receptor can be exposed to a contaminated medium.

The SLERA assumes that the only source of chemical contamination (the stressor) is operation of the OB/OD Unit. Components of the operation include open burning, open detonation, static firing, and operation of a deactivation furnace. Each of these operations emits chemicals into the air. Movement of the air carries the chemicals into the surrounding landscape. Ultimately, airborne chemicals are deposited onto the soils, surface water, and sediments in the landscape (the exposure media). Receptors are exposed to the chemicals through direct contact with contaminated media, ingestion (or inhalation) of the media, or ingestion of other receptors who have accumulated the chemicals from the media into their tissues (a process termed bioaccumulation). For example, a herbivorous mammal inhabiting a terrestrial landscape (e.g., Locations 1, 2, or 3) can be exposed to soil-borne contamination not only by ingesting the soil but also by ingesting plants that have translocated chemicals from the soil into foliage or fruit. Carnivorous mammals and birds are particularly susceptible to high dietary exposure levels because they ingest prey organisms that have accumulated high levels of chemicals through their food sources.

2.1.4 Assessment Endpoints

Assessment endpoints are defined as explicit expressions of environmental values that are to be protected (U.S. EPA, August 1999). Assessment endpoints are typically defined broadly for a SLERA and can be narrowed in focus at later stages in the ERA process. For this SLERA, the assessment endpoints consist of the general welfare of broad categories of ecological receptors inhabiting the landscape on and in the vicinity of TEAD, including:

- Terrestrial Plants (Locations 1, 2, and 3),
- Soil Invertebrates (e.g., earthworms, microorganisms) (Locations 1, 2, and 3),
- Aquatic Plants (e.g., phytoplankton, emergent plants) (Locations 4 and 5),
- Aquatic Invertebrates (e.g. benthic macroinvertebrates) (Locations 4 and 5),
- Fish (Locations 4 and 5),
- Herbivorous Mammals (Locations 1, 2, 3, 4, and 5),
- Omnivorous Mammals (Locations 1, 2, 3, 4, and 5),
- Carnivorous Mammals (Locations 1, 2, 3, 4, and 5),
- Herbivorous Birds (Locations 1, 2, 3, 4, and 5),
- Omnivorous Birds (Locations 1, 2, 3, 4, and 5), and
- Carnivorous Birds (Locations 1, 2, 3, 4, and 5).

Table 2.1.3-1. Conceptual site model: exposure pathways

Source	Release mechanism	Exposure medium	Exposure mechanism	Receptors: Terrestrial plants	Soil invertebrates	Aquatic plants	Benthic invertebrates	Fish	Mammals	Birds
Open Burning,	Emissions	Air	Inhalation						L1, L2, L3	L1, L2, L3
Open Detonation,	into the Air		Direct Contact	L1, L2, L3	L1, L2, L3				L1, L2, L3	L1, L2, L3
Static Firing, and		Soil	Direct Contact	**L1, L2, L3**	**L1, L2, L3**					
Operation of			Ingestion						**L1, L2, L3**	**L1, L2, L3**
Deactivation			Food Chain						**L1, L2, L3**	**L1, L2, L3**
Furnace (as an		Surface	Direct Contact			**L4, L5**	**L4, L5**	**L4, L5**	L4, L5	L4, L5
onsite source that		Water	Ingestion						**L4, L5**	**L4, L5**
contributes to			Food Chain						**L4, L5**	**L4, L5**
local background)		Sediment	Direct Contact			**L4, L5**	**L4, L5**	**L4, L5**	L4, L5	L4, L5
			Ingestion						**L4, L5**	**L4, L5**
			Food Chain						**L4, L5**	**L4, L5**

Notes:

1. Locations: L1-Location of Maximum Deposition on TEAD; L2-Location of Maximum Deposition off TEAD; L3-Box Elder Wash; L4-Grantsville Reservoir, L5-Rush Lake.
2. The presence of a location symbol indicates a theoretically complete exposure pathway.
3. A bold location symbol indicates an exposure pathway that is accounted for quantitatively in the exposure calculations performed as part of the Screening Level Ecological Risk Assessment (SLERA).

2.1.5 Measurement Endpoints

Measurement endpoints are measurable characteristics that are related to the assessment endpoints and that can be used to assess potential impacts to the assessment endpoints. The SLERA uses exposure point concentrations as the measurement endpoint for assessment endpoints corresponding to receptors that directly inhabit potentially contaminated media. These include terrestrial plants, soil invertebrates, aquatic plants, aquatic invertebrates, and fish. Exposure point concentrations are the concentrations (measured or estimated) of the chemicals in affected media at each location. The affected media are soil at Locations 1, 2, and 3 and surface water and sediment at Locations 4 and 5. The exposure point concentrations are estimated using dispersion modeling for Locations 1, 2, 4, and 5 and measured from soil samples collected at Box Elder Wash for Location 3. The SLERA uses estimated doses received by each functional feeding guild as the measurement endpoint for assessment endpoints corresponding to mammals and birds.

Table 2.1.5-1 presents the assessment endpoints and corresponding measurement endpoints for each exposure pathway evaluated quantitatively in the SLERA.

2.2 EXPOSURE ASSESSMENT

Exposure is quantification of the contact between the receptors and stressors. The SLERA used EcoRiskView, a computer program commercially developed to calculate exposures commensurate with the August 1999 EPA Protocol. The exposure calculations involved (1) quantifying the dispersion of chemicals from the OB/OD Unit to the locations under consideration; and (2) quantifying the doses of chemicals ingested by those receptors whose primary exposure pathway is ingestion rather than direct exposure. EcoRiskView was used to calculate estimated concentrations of each chemical in soil at Locations 1 and 2 and in surface water and sediment at Locations 4 and 5. Concentrations in soil at Box Elder Wash (Location 3) were determined directly by laboratory analysis of soil samples rather than estimated using EcoRiskView.

For measurement endpoints involving exposure through ingestion of chemicals, EcoRiskView calculated estimated doses based on the ingestion rates shown in Table 2.2-1. The dose calculations used the media concentrations estimated by dispersion modeling (for Locations 1, 2, 4 and 5) and the soil concentrations obtained from laboratory analysis (for Box Elder Wash, Location 3).

2.3 ECOLOGICAL EFFECTS (TOXICITY) ASSESSMENT

The SLERA uses toxicity reference values (TRVs) corresponding to the measurement endpoints as measures of the toxicity of individual chemicals emitted from the OB/OD Unit. For measurement endpoints corresponding to receptors that directly inhabit affected media, the TRVs represent the highest exposure point concentrations reported in the scientific literature to not result in adverse effects to the receptors. For measurement endpoints corresponding to doses, the TRVs represent no observed adverse effect level (NOAEL) doses. NOAEL doses are the highest doses reported in the scientific literature to not result in adverse effects to the receptors. Table 2.3-1 lists the TRVs used in the SLERA, which are those published in EPA, 1999.

Table 2.1.5-1. Proposed Ecological Endpoints, Exposure Pathways, and Risk Calculations Screening Level Ecological Risk Assessment (SLERA)

Location (habitat type)	Assessment endpoint	Measurement endpoint	Exposure	Materials ingested	Proposed risk calculation
Location of Maximum Deposition on TEAD (Upland Grassland/Scrub) (Location 1)	Terrestrial Plants (TL 1)	Community	Direct Contact with Soil	N/A	ESQ = EPC in Soil/TRV (TRV from Table E-5)
	Soil Invertebrates (TL 1)	Community	Direct Contact with Soil	N/A	ESQ = EPC in Soil/TRV (TRV from Table E-6)
	Herbivorous Mammals (TL 2)	Deer Mouse	Ingestion	• Terrestrial Plants • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Omnivorous Mammals (TL 3)	White-Footed Mouse	Ingestion	• Terrestrial Plants • TL 2 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Carnivorous Mammals (TL 4)	Red Fox	Ingestion	• TL 3 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Herbivorous Birds (TL 2)	Mourning Dove	Ingestion	• Terrestrial Plants • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Omnivorous Birds (TL 3)	Western Meadowlark	Ingestion	• Terrestrial Plants • TL 2 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Carnivorous Birds (TL 4)	American Kestrel	Ingestion	• TL 3 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)

Table 2.1.5-1 (Continued)

Location (habitat type)	Assessment endpoint	Measurement endpoint	Exposure	Materials ingested	Proposed risk calculation
Location of Maximum Deposition off of TEAD (Upland Grassland/Scrub) (Location 2)	Terrestrial Plants (TL 1)	Community	Direct Contact with Soil	N/A	ESQ = EPC in Soil/TRV (TRV from Table E-5)
	Soil Invertebrates (TL 1)	Community	Direct Contact with Soil	N/A	ESQ = EPC in Soil/TRV (TRV from Table E-6)
	Herbivorous Mammals (TL 2)	Deer Mouse	Ingestion	• Terrestrial Plants • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Omnivorous Mammals (TL 3)	White-Footed Mouse	Ingestion	• Terrestrial Plants • TL 2 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Carnivorous Mammals (TL 4)	Red Fox	Ingestion	• TL 3 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Herbivorous Birds (TL 2)	Mourning Dove	Ingestion	• Terrestrial Plants • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Omnivorous Birds (TL 3)	Western Meadowlark	Ingestion	• Terrestrial Plants • TL 2 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Carnivorous Birds (TL 4)	American Kestrel	Ingestion	• TL 3 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)

Table 2.1.5-1 (Continued)

Location (habitat type)	Assessment endpoint	Measurement endpoint	Exposure	Materials ingested	Proposed risk calculation
Box Elder Wash	Terrestrial Plants (TL 1)	Community	Direct Contact with Soil	N/A	ESQ = EPC in Soil/TRV (TRV from Table E-5)
(Dry Wash Bordered by Upland Grassland/Scrub – Treated as Dry)	Soil Invertebrates (TL 1)	Community	Direct Contact with Soil	N/A	ESQ = EPC in Soil/TRV (TRV from Table E-6)
	Herbivorous Mammals (TL 2)	Deer Mouse	Ingestion	• Terrestrial Plants • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
Location 3	Omnivorous Mammals (TL 3)	White-Footed Mouse	Ingestion	• Terrestrial Plants • TL 2 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Carnivorous Mammals (TL 4)	Red Fox	Ingestion	• TL 3 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Herbivorous Birds (TL 2)	Mourning Dove	Ingestion	• Terrestrial Plants • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Omnivorous Birds (TL 3)	Western Meadowlark	Ingestion	• Terrestrial Plants • TL 2 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Carnivorous Birds (TL 4)	American Kestrel	Ingestion	• TL 3 Prey • Soil	ESQ = Ingested Dose/TRV (TRV from Table E-8)

Table 2.1.5-1 (Continued)

Location (habitat type)	Assessment endpoint	Measurement endpoint	Exposure	Materials ingested	Proposed risk calculation
Grantsville Reservoir	Aquatic Plants (TL 1)	Community	Direct Contact with Surface Water	N/A	ESQ = EPC in Water/TRV (TRV from Table E-1)
			Direct Contact with Sediments	N/A	ESQ = EPC in Sediment/TRV (TRV from Table E-3)
(Open Water with marshy fringe)	Benthic Invertebrates	Community	Direct Contact with Surface Water	N/A	ESQ = EPC in Water/TRV (TRV from Table E-1)
(Location 4)	(TL 1)		Direct Contact with Sediments	N/A	ESQ = EPC in Sediment/TRV (TRV from Table E-3)
	Fish (TL 2)	Community	Direct Contact with Surface Water	N/A	ESQ = EPC in Water/TRV (TRV from Table E-1)
	Herbivorous Mammals (TL 2)	Muskrat	Ingestion	• Aquatic Plants • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Omnivorous Mammals (TL 3)	Short-Tailed Shrew	Ingestion	• Aquatic Plants • TL 2 Prey • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Carnivorous Mammals (TL 4)	Mink	Ingestion	• TL 3 Prey • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Herbivorous Birds (TL 2)	Canvasback	Ingestion	• Aquatic Plants • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Omnivorous Birds (TL 3)	Mallard	Ingestion	• Aquatic Plants • TL 2 Prey • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Piscivorous Birds (TL 4)	Spotted Sandpiper	Ingestion	• Fish • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-8)

Table 2.1.5-1 (Continued)

Location (habitat type)	Assessment endpoint	Measurement endpoint	Exposure	Materials ingested	Proposed risk calculation
Rush Lake	Aquatic Plants (TL 1)	Community	Direct Contact with Surface Water	N/A	ESQ = EPC in Water/TRV (TRV from Table E-1)
(Wetland/Shallow Water)			Direct Contact with Sediments	N/A	ESQ = EPC in Sediment/TRV (TRV from Table E-3)
(Location 5)	Benthic Invertebrates (TL 1)	Community	Direct Contact with Surface Water	N/A	ESQ = EPC in Water/TRV (TRV from Table E-1)
			Direct Contact with Sediments	N/A	ESQ = EPC in Sediment/TRV (TRV from Table E-3)
	Fish (TL 2)	Community	Direct Contact with Surface Water	N/A	ESQ = EPC in Water/TRV (TRV from Table E-1)
	Herbivorous Mammals (TL 2)	Muskrat	Ingestion	• Aquatic Plants • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Omnivorous Mammals (TL 3)	Short-Tailed Shrew	Ingestion	• Aquatic Plants • TL 2 Prey • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Carnivorous Mammals (TL 4)	Mink	Ingestion	• TL 3 Prey • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-7)
	Herbivorous Birds (TL 2)	Canvasback	Ingestion	• Aquatic Plants • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Omnivorous Birds (TL 3)	Mallard	Ingestion	• Aquatic Plants • TL 2 Prey • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-8)
	Piscivorous Birds (TL 4)	Spotted Sandpiper	Ingestion	• Fish • Surface Water • Sediment	ESQ = Ingested Dose/TRV (TRV from Table E-8)

TL: Trophic Level; ESQ: Ecological Screening Quotient; TRV: Toxicity Reference Value; EPC: Exposure Point Concentration
The TRV Tables referenced in the table are in Appendix E of *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA530-D-99-001A.

Table 2.2-1. Ingestion rates for wildlife species selected as measurement endpoints screening level ecological risk assessment.

Species	Feeding guild	Body weight (kg)	Food ingestion rate[a] (kg WW/kg BW-day)	Water ingestion rate (L/kg BW-day)	Soil/sediment ingestion rate (kg DW/kg BW-day)
Deer Mouse	Herbivorous Mammals (at Locations 1, 2, and 3)	1.48E-02	5.99E-01	1.51E-01	1.44E-03
White-Footed Mouse	Omnivorous Mammals (at Locations 1, 2, and 3)	1.00E-02	6.14E-01	1.52E-01	2.70E-03
Red Fox	Carnivorous Mammals (at Locations 1, 2, and 3)	3.94E0	1.68E-01	8.63E-02	1.51E-03
Mourning Dove	Herbivorous Birds (at Locations 1, 2, and 3)	1.50E-01	3.49E-01	1.09E-01	7.01E-03
Western Meadowlark	Omnivorous Birds (at Locations 1, 2, and 3)	9.00E-02	4.21E-01	1.31E-01	1.39E-02
American Kestrel	Carnivorous Birds (at Locations 1, 2, and 3)	1.00E-01	4.02E-01	1.25E-01	1.39E-03
Muskrat	Herbivorous Mammals (at Locations 4 and 5)	1.09E0	2.67E-01	9.82E-02	6.41E-04
Short-Tailed Shrew	Omnivorous Mammals (at Locations 4 and 5)	1.50E-02	6.20E-01	1.51E-01	1.36E-02
Mink	Carnivorous Mammals (at Locations 4 and 5)	9.74E-01	2.16E-01	9.93E-02	1.93E-03
Canvasback	Herbivorous Birds (at Locations 4 and 5)	7.70E-01	1.99E-01	6.43E-02	1.82E-03
Mallard	Omnivorous Birds (at Locations 4 and 5)	1.04E0	1.79E-01	5.82E-02	3.18E-03
Spotted Sandpiper	Carnivorous Shorebirds (at Locations 4 and 5)	4.00E-02	5.69E-01	1.74E-01	4.15E-02

[a]Food Ingestion Rate for Herbivorous species will be assumed to be 100% plants. Food Ingestion Rate for Omnivorous species will be assumed to be 50% plants and 50% TL 2 flesh. Food Ingestion Rate for Carnivorous Species will be assumed to be 100% TL 3 flesh. Food Ingestion Rate for Carnivorous Shorebird Species will be assumed to be 50% TL 3 flesh and 50% fish.

Table 2.3-1. Toxicity reference values used in the screening level ecological risk assessment
Note: All TRVs are from Appendix E of the Screening Level Ecological Risk Assessment Protocol (EPA, 1999)

	Plant	Soil invertebrate	Freshwater	Sediment	Mammal	Bird
	TRV basis: conc. in soil (dry weight)	TRV basis: conc. in soil (dry weight)	TRV basis: conc. in surface water	TRV basis: conc. in sediment (dwt.)	TRV basis: ingested dose	TRV basis: ingested dose
Analyte	mg/L (inorganics) µg/L (organics)	mg/L (inorganics) µg/L (organics)	mg/L (inorganics) µg/L (organics)	mg/L (inorganics) µg/L (organics)	mg/kg BW/day (in) µg/kg BW/day (org)	mg/kg BW/day (in) µg/kg BW/day (org)
Aluminum	5		0.087	14,000	1.93	100
Antinomy	0.5		0.03	64.0	0.066	
Arsenic	1	0.25	0.15	6.0	1.25	2.46
Barium	5		0.004	20	0.51	20.8
Benzene						
Beryllium	0.1		0.00066		0.66	
Cadmium	0.2	10	0.0022	0.6	0.0252	1.45
Carbon Tetrachloride						
Chlorine						
Chloroethane						
Chloroform			28	59.4	60,000	
Chromium (III)				26		
Chromium (VI)	0.018	0.2	0.011		3.5	1.0
Copper	1.0	32.0	0.009	16	12.0	46.97
Cyanide			0.0052	0.1	24	0.04
Dibenzo(a,h)-anthracene	1,200	25,000	0.027	10	2	0.39
Diethyl phthalate						
1,3-Dinitrobenzene		2,260	26	21.4	1,051	0.422
2,4-Dinitrotoluene			23	46.9	700	
2,6-Dinitrotoluene			60	100.6	400	
Ethylbenzene						
Hexachloro-benzene			3.68	20	1,600	225
Hydrogen Chloride						
Lead	4.6	100	0.0025	31	0.0375	0.025
Mercuric Chloride	0.349	2.5	0.00077	0.2	1.01	3.25
Methyl Chloride						
Methyl Mercury		2.5	0.0000028	0.2	0.032	0.0064
Methylene Chloride						
Nickel	25	100	0.052	16	50	65
Nitrobenzene		2,260	270	1285.2		
Pentachloro-phenol	1,730	10,000	15	7,000	300	4,030
Selenium	0.05	7.7	0.005	0.1	0.076	0.5

Table 2.3-1 (Continued)

Analyte	Plant TRV basis: conc. in soil (dry weight) mg/L (inorganics) µg/L (organics)	Soil invertebrate TRV basis: conc. in soil (dry weight) mg/L (inorganics) µg/L (organics)	Freshwater TRV basis: conc. in surface water mg/L (inorganics) µg/L (organics)	Sediment TRV basis: conc. in sediment (dwt.) mg/L (inorganics) µg/L (organics)	Mammal TRV basis: ingested dose mg/kg BW/day (in) µg/kg BW/day (org)	Bird TRV basis: ingested dose mg/kg BW/day (in) µg/kg BW/day (org)
Silver	0.02		0.00012	4.5	0.375	178
Styrene						
2,3,7,8-TetraCDD		500	0.0000038	0.41	0.001	0.01
PCE						
Thallium (I)	0.01		0.004		0.0131	0.35
Toluene						
1,3,5(sym)tri-nitrobenzene						
2,4,6-Trinitrotoluene						
Vinyl Chloride			3,880	1722.7	170	
Zinc	0.9	199	0.118	110	10.4	130.9

Note: A space indicates that no TRV is available from Appendix E of EPA, 1999. For purposes of units in the table, mercuric chloride and methyl mercury are considered to be inorganic.

2.4 RISK CHARACTERIZATION

Risk characterization in the SLERA consists of calculating ecological screening quotients (ESQs, often referred to as hazard quotients, HQs) for each chemical evaluated, for each group of receptors corresponding to one of the assessment endpoints. An ESQ less than 1.0 indicates that there is little or no potential for adverse risk to the corresponding assessment endpoint. An ESQ equal to or greater than 1.0 indicates that there is a potential for adverse risk to the corresponding assessment endpoint. The ESQs represent the values used to quantify exposure (exposure point concentrations or doses) divided by the corresponding TRV. The last column in Table 2.1.5-1 indicates the ESQ calculation performed for each assessment endpoint addressed in the SLERA.

The ESQs were calculated using the EcoRiskView computer program that was used to estimate exposure levels. The EcoRiskView is a commercial model that is based on the Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (U.S. EPA, August 1999). The TRVs from EPA, 1999, are programmed into EcoRiskView, which automatically divides the estimated exposure level by the corresponding TRV. The results are discussed below. EcoRiskView output files are presented in Appendix 2.4-A. Values for site-specific setting parameters were the same as used for IRAP (i.e., for the human health risk assessment) and included in Appendix 2.4-A.

Location of Maximum On-site Deposition (Location 1): Table 2.4-1 presents the ESQs calculated for the location of maximum on-site deposition. Only those ESQs greater than zero (0.00E0) are presented. For a given chemical analyte, EcoRiskView calculated an ESQ of 0.00E0 whenever (1) the concentration estimated by the program for the subject medium at the subject location is zero or (2) a corresponding TRV was not available. Table 2.3-1 indicates which chemical analytes possess TRVs used by EcoRiskView.

For the Uncertainty Risk Emissions Scenario, chemical analytes for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Location 1 include:

- Dibenzo(a,h)anthracene
- Hexachlorobenzene
- Methyl Mercury (methyl mercury is not a potential OB/OD Unit emission COPC but was used as a conservative surrogate for inorganic mercury)
- Pentachlorophenol
- 2,3,7,8-TCDD.

For the Average Risk Emissions Scenario, the only chemical analyte for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Location 1 is 2,3,7,8-TCDD. All ESQs calculated by the program for the Primary Risk Emissions Scenario were zero.

Location of Maximum Off-site Deposition (Location 2): Table 2.4-2 presents the ESQs calculated for the location of maximum off-site deposition. Only those ESQs greater than zero (0.00E0) are presented. For a given chemical analyte, EcoRiskView calculated an ESQ of 0.00E0 whenever (1) the concentration estimated by the program for the subject medium at the subject location is zero or (2) a corresponding TRV was not available. Table 2.3-1 indicates which chemical analytes possess TRVs used by EcoRiskView.

Table 2.4-1. Ecological screening quotients greater than zero location of maximum on-site deposition (upland sagebrush and grassland habitat)

Analyte	TP	INV	HM	OM	CM	HB	OB	CB	COPEC
Uncertainty risk emissions scenario									
Cyanide			7.60E-09	8.92E-07	3.72E-07	2.16E-05	6.35E-04	2.63E-04	No
Dibenzo(a,h)anthracene	2.16E-04	4.51E-03	**3.24E+01**	**9.00E0**	**1.86E0**	**9.70E+01**	**4.88E+01**	**1.15E+01**	Yes
1,3-Dinitrobenzene	1.72E-06		1.43E-06	1.05E-06	2.87E-07	2.13E-03	3.06E-03	8.41E-04	No
2,4-Dinitrotoluene			2.26E-06	6.01E-06	2.23E-06				No
2,6-Dinitrotoluene			3.94E-06	7.64E-06	2.73E-06				No
Hexachlorobenzene			9.55E-05	**9.64E0**	**2.47E+01**	1.60E-03	**7.79E+01**	**2.12E+02**	Yes
Mercuric Chloride			8.93E-02	2.06E-01	1.19E-01	5.75E-02	1.32E-01	2.99E-02	No
Methyl Mercury			1.41E-01	**1.60E+01**	**6.54E0**	7.88E-01	**9.17E+01**	**3.93E+01**	Yes
Nitrobenzene	2.83E-07								No
Pentachlorophenol			1.90E-04	**1.41E0**	**2.07E0**	1.23E-05	1.20E-01	1.86E-01	Yes
2,3,7,8-TCDD	5.28E-06		1.67E-02	**1.39E0**	**4.38E0**	2.60E-03	3.54E-03	5.28E-01	Yes
Average risk emissions scenario									
Cyanide			1.39E-07	1.65E-05	6.90E-06	3.99E-04	1.18E-02	4.87E-03	No
2,3,7,8-TCDD	3.44E-04		**1.09E0**	**9.02E+01**	**2.85E+02**	1.70E-01	2.31E-01	**3.44E+01**	Yes

TP: Terrestrial Plant. INV: Soil Invertebrate. HM: Herbivorous Mammal. OM: Omnivorous Mammal.
CM: Carnivorous Mammal. HB: Herbivorous Bird. OB: Omnivorous Bird. CB: Carnivorous Mammal.
COPC: Retained as Contaminant of Potential Ecological Concern by SLERA.

Table 2.4-2. Ecological screening quotients greater than zero location of maximum off-site deposition (upland sagebrush and grassland habitat)

Analyte	TP	INV	HM	OM	CM	HB	OB	CB	COPEC
Uncertainty risk emissions scenario									
Cyanide			1.18E-08	1.40E-06	5.85E-07	3.38E-05	9.98E-04	4.13E-04	No
Dibenzo(a,h)anthracene	2.30E-04	4.79E-03	**3.45E+01**	**9.57E0**	**1.98E0**	**1.03E+02**	**5.19E+01**	**1.22E+01**	Yes
1,3-Dinitrobenzene	1.83E-06		1.51E-06	1.12E-06	3.04E-07	2.26E-03	3.24E-03	8.92E-04	No
2,4-Dinitrotoluene			2.40E-06	6.37E-06	2.37E-06				No
2,6-Dinitrotoluene			4.18E-06	8.11E-06	2.90E-06				No
Hexachlorobenzene			1.02E-04	**1.02E+01**	**2.63E+01**	1.70E-03	**8.29E+01**	**2.26E+02**	Yes
Mercuric Chloride			9.05E-02	2.09E-01	1.21E-01	5.82E-02	1.34E-01	3.03E-02	No
Methyl Mercury			1.43E-01	**1.63E+01**	**6.62E0**	7.99E-01	**9.30E+01**	**3.98E+01**	Yes
Nitrobenzene	3.00E-07								No
Pentachlorophenol			2.98E-04	**2.22E0**	**3.25E0**	1.94E-05	1.88E-01	2.92E-01	Yes
2,3,7,8-TCDD	5.61E-06		1.78E-02	**1.47E0**	**4.66E0**	2.77E-03	3.77E-03	5.61E-01	Yes
Average risk emissions scenario									
Cyanide			1.12E-07	1.32E-05	5.52E-06	3.20E-04	9.42E-03	3.90E-03	No
2,3,7,8-TCDD	5.34E-04		**1.69E0**	**1.40E+02**	**4.43E+02**	2.63E-01	3.59E-01	**5.34E+01**	Yes

TP: Terrestrial Plant. INV: Soil Invertebrate. HM: Herbivorous Mammal. OM: Omnivorous Mammal. CM: Carnivorous Mammal. HB: Herbivorous Bird. OB: Omnivorous Bird. CB: Carnivorous Mammal. COPC: Retained as Contaminant of Potential Ecological Concern by SLERA.

For the Uncertainty Risk Emissions Scenario, chemical analytes for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Location 2 include:

- Dibenzo(a,h)anthracene
- Hexachlorobenzene
- Methyl Mercury
- Pentachlorophenol
- 2,3,7,8-TCDD.

For the Average Risk Emissions Scenario, the only chemical analyte for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Location 1 is 2,3,7,8-TCDD. All ESQs calculated by the program for the Primary Risk Emissions Scenario were zero. The results generally parallel the results for Location 1.

Box Elder Wash (Location 3): Table 2.4-3 presents the ESQs calculated for Box Elder Wash based on soil sampling data (that include site background contributions to risk). The ESQs for Box Elder Wash are based on laboratory analysis of soil samples rather than on estimated concentrations calculated using dispersion modeling. All ESQs, even those of zero (0.00E0), are presented in the table. For a given chemical analyte, EcoRiskView calculated an ESQ of 0.00E0 whenever (1) the concentration estimated by the program for the subject medium at the subject location is zero or (2) a corresponding TRV was not available. Table 2.3-1 indicates which chemical analytes possess TRVs used by EcoRiskView.

Chemical analytes for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Location 2 include:

- Aluminum
- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium (hexavalent)
- Copper
- Cyanide
- Dibenzo(a,h)anthracene
- 1,3-Dinitrobenzene
- Hexachlorobenzene
- Lead
- Selenium
- Silver
- 2,3,7,8-TetraCDD
- Thallium
- Zinc

Grantsville Reservoir (Location 4): Table 2.4-4 presents the ESQs calculated for the location of maximum on-site deposition. Only those ESQs greater than zero (0.00E0) are presented. For a given chemical analyte, EcoRiskView calculated an ESQ of 0.00E0 whenever (1) the concentration estimated by the program for the subject medium at the subject location is zero or (2) a corresponding TRV was not available. Table 2.3-1 indicates which chemical analytes possess TRVs used by EcoRiskView.

Table 2.4-3. Ecological screening quotients soil in Box Elder Wash

Analyte	TP	INV	HM	OM	CM	HB	OB	CB	COPEC
Aluminum	0.00E0	**2.20E+03**	**9.85E0**	**4.01E+02**	**6.13E+01**	7.90E-01	**6.63E0**	**2.59E0**	Yes
Antimony	0.00E0	**3.20E0**	3.83E-01	**1.88E0**	2.61E-01	0.00E0	0.00E0	0.00E0	Yes
Arsenic	**2.20E+01**	**5.50E0**	1.77E-02	1.66E-01	2.70E-02	1.90E-02	8.49E-02	2.78E-02	Yes
Benzene	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Beryllium	0.00E0	**5.10E0**	1.67E-03	5.46E-02	8.31E-03	0.00E0	0.00E0	0.00E0	Yes
Cadmium	6.20E-02	**3.10E0**	6.79E-01	**7.65E0**	**1.03E0**	9.52E-03	9.63E-02	4.21E-02	Yes
Carbon tetrachloride	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Chlorine	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Chloroethane	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Chloroform	0.00E0	0.00E0	1.20E-06	6.01E-06	7.40E-07	0.00E0	0.00E0	0.00E0	No
Chromium	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Chromium, hexavalent	**6.50E+01**	**8.67E+02**	5.35E-03	1.00E-02	5.61E-03	9.11E-02	1.81E-01	1.81E-02	Yes
Copper	4.38E-01	**1.40E+01**	3.52E-02	3.47E-02	3.72E-03	7.08E-03	9.66E-03	1.61E-01	Yes
Cyanide	N/A	0.00E0	3.54E-05	8.52E-03	1.19E-03	1.03E-01	**3.68E0**	**1.68E0**	Yes
Dibenzo(a,h)anthracene	1.56E-02	3.25E-01	3.71E-01	**4.76E0**	**8.43E0**	**7.28E0**	**2.88E+01**	**1.00E+02**	Yes
Diethyl phthalate	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
1,3-Dinitrobenzene	1.11E-01	0.00E0	9.13E-02	1.34E-01	1.22E-02	**1.36E+02**	**2.36E+02**	**7.17E+01**	Yes
2,4-Dinitrotoluene	0.00E0	0.00E0	7.03E-02	3.74E-01	4.67E-02	0.00E0	0.00E0	0.00E0	No
2,6-Dinitrotoluene	0.00E0	0.00E0	1.42E-01	5.54E-01	6.66E-02	0.00E0	0.00E0	0.00E0	No
Ethylbenzene	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Hexaclorobenzene	0.00E0	0.00E0	7.98E-04	**1.72E+02**	**1.48E+02**	1.40E-02	**8.38E+02**	**2.52E+03**	Yes
Hydrogen Chloride	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Lead	1.10E-01	**2.39E0**	**1.37E0**	**3.98E0**	8.13E-01	**3.91E0**	**9.39E0**	**1.94E0**	Yes
Methyl Chloride	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Methylene Chloride	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Nickel	1.40E-01	5.60E-01	1.05E-03	2.81E-03	6.59E-04	1.80E-03	4.07E-03	7.33E-04	No
Nitrobenzene	1.11E-01	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Selenium	7.66E-02	**1.18E+01**	2.01E-02	5.50E-01	9.16E-02	9.06E-03	7.15E-02	3.07E-02	Yes
Silver	0.00E0	**6.00E+01**	9.66E-02	2.72E-01	3.44E-02	1.60E-04	4.74E-04	1.59E-04	Yes
2,3,7,8-TetraCDD	4.60E-03	0.00E0	**4.24E0**	**6.68E0**	**7.11E+02**	**1.76E0**	**3.23E0**	**1.70E+02**	Yes
PCE	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Thallium (I)	0.00E0	**1.20E+02**	1.58E-01	**6.45E0**	9.85E-01	2.46E-02	2.07E-01	8.06E-02	Yes
Toluene	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
1,3,5(sym-)trinitrobenze.	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
2,4,6-Trinitrotoluene	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	No
Vinyl Chloride	0.00E0	0.00E0	1.39E-03	1.16E-03	6.32E-05	0.00E0	0.00E0	0.00E0	No
Zinc	2.66E-01	**5.89E+01**	7.34E-03	8.90E-01	1.28E-01	2.84E-03	5.34E-02	2.34E-02	Yes

TP: Terrestrial Plant. INV: Soil Invertebrate. HM: Herbivorous Mammal. OM: Omnivorous Mammal.
CM: Carnivorous Mammal. HB: Herbivorous Bird. OB: Omnivorous Bird. CB: Carnivorous Bird.
COPC: Retained as Contaminant of Potential Ecological Concern by SLERA .

Table 2.4-4. Ecological screening quotients greater than zero Grantsville Reservoir

Analyte	FW	SED	HM	OM	CM	HB	OB	CSB	COPEC
Uncertainty risk emissions scenario									
Cyanide	7.52E-06		2.00E-10	2.00E-10	4.48E-08	6.30E-08	5.69E-08	3.53E-04	No
Dibenzo(a,h)anthracene	5.93E-05	9.71E-02	5.72E-05	1.25E-02	2.37E-02	3.86E-04	1.84E-02	5.66E-03	No
1,3-Dinitrobenzene	9.62E-08	3.14E-08	3.00E-09	4.40E-09	7.90E-09	5.57E-06	3.21E-06	2.51E-04	No
2,4-Dinitrotoluene	1.09E-07	1.32E-08	5.50E-09	1.34E-07	2.13E-08				No
2,6-Dinitrotoluene	4.17E-08	1.16E-08	9.40E-09	1.94E-08	7.40E-09				No
Hexachlorobenzene	9.08E-06	1.01E-02	4.72E-07	4.49E-02	3.94E-02	3.10E-06	9.22E-02	3.88E-05	No
Mercuric Chloride	2.78E-03	**5.69E+01**	5.65E-04	2.45E-03	4.21E-04	1.53E-04	2.08E-04	1.34E-03	**Yes**
Nitrobenzene		1.49E-09							No
Pentachlorophenol	3.33E-06	1.28E-04	5.88E-08	1.08E-03	5.41E-04	3.40E-09	2.32E-05	7.81E-07	No
2,3,7,8-TCDD		**6.00E0**	4.90E-05	**1.39E+02**	**2.71E+02**	6.72E-06	**4.01E0**	1.46E-04	**Yes**
Average risk emissions scenario									
Cyanide	9.23E-05		2.00E-09	3.00E-09	5.49E-07	7.72E-07	6.98E-07	4.32E-03	No
2,3,7,8-TCDD		**5.01E+02**	4.07E-03	**1.16E+04**	**2.26E+04**	5.59E-04	**3.34E+02**	1.22E-02	**Yes**

FW: Communities Inhabiting Fresh Water. SED: Communities Inhabiting Freshwater Sediment.
HM: Herbivorous Mammal. OM: Omnivorous Mammal. CM: Carnivorous Mammal.
HB: Herbivorous Bird. OB: Omnivorous Bird. CB: Carnivorous Shore Bird.
COPC: Retained as Contaminant of Potential Ecological Concern by SLERA.

For the Uncertainty Risk Emissions Scenario, the only chemical analytes for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Grantsville Reservoir are mercuric chloride and 2,3,7,8-TCDD. For the Average Risk Emissions Scenario, the only chemical analyte for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Grantsville Reservoir is 2,3,7,8-TCDD. All ESQs calculated by the program for the Primary Risk Emissions Scenario were zero.

Rush Lake (Location 5): Table 2.4-5 presents the ESQs calculated for the location of maximum on-site deposition. Only those ESQs greater than zero (0.00E0) are presented. For a given chemical analyte, EcoRiskView calculated an ESQ of 0.00E0 whenever (1) the concentration estimated by the program for the subject medium at the subject location is zero or (2) a corresponding TRV was not available. Table 2.3-1 indicates which chemical analytes possess TRVs used by EcoRiskView.

For the Uncertainty Risk Emissions Scenario, the only chemical analytes for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Grantsville Reservoir are mercuric chloride and 2,3,7,8-TCDD. For the Average Risk Emissions Scenario, the only chemical analyte for which the program calculated an ESQ equal to or greater than 1.0 for at least one assessment endpoint at Grantsville Reservoir is 2,3,7,8-TCDD. All ESQs calculated by the program for the Primary Risk Emissions Scenario were zero. The results for Rush Lake generally parallel the results for Grantsville Reservoir.

2.5 CONCLUSIONS

Summary: Based on the risk characterization results presented in Section 2.4, the SLERA concludes that no further consideration of potential ecological risk although the following chemical analytes had ESQ values greater than 1.0:

- Dibenzo(a,h)anthracene
- Hexachlorobenzene
- Methyl Mercury
- Pentachlorophenol
- 2,3,7,8-TCDD
- Selenium
- Silver

However, none of these COPECs are included in the Primary Risk and Average Risk OB/OD/SF emission factor data base. These COPECs are only based on MQL-derived emission factors (i.e., they were not detected in the BangBox emission tests for OB/OD sources). Furthermore, of the above COPECs list only inorganic mercury (not methyl mercury) and silver were detected in surface soils based on the OB/OD Unit baseline sampling program.

The risk characterization also resulted in ESQs greater than 1.0 for several other inorganic constituents. However, these other inorganic constituents are natural components of uncontaminated soils and were detected at concentrations very close to site background concentrations determined for uncontaminated soils in the vicinity of TEAD. Table 2.5-1 presents the maximum detected values for soil samples from Box Elder Wash compared to background threshold values determined for uncontaminated natural soils in the vicinity of TEAD.

Table 2.4-5. Ecological screening quotients greater than zero Rush Lake

Analyte	FW	SED	HM	OM	CM	HB	OB	CSB	COPEC
Uncertainty risk emissions scenario									
Cyanide	9.50E-06		2.00E-10	4.00E-10	5.64E-08	7.94E-08	7.18E-08	4.45E-04	No
Dibenzo(a,h)anthracene	7.41E-06	1.52E-02	8.93E-06	1.95E-03	3.70E-03	6.02E-05	2.88E-03	8.85E-04	No
1,3-Dinitrobenzene	3.65E-06	1.17E-06	1.15E-07	1.65E-07	3.01E-07	2.11E-04	1.22E-04	9.51E-03	No
2,4-Dinitrotoluene	3.16E-06	4.01E-07	1.64E-07	4.01E-06	6.36E-07				No
2,6-Dinitrotoluene	1.41E-06	3.84E-07	3.19E-07	6.58E-07	2.52E-07				No
Hexachlorobenzene	1.97E-05	2.19E-02	1.02E-06	9.74E-02	8.55E-02	6.72E-06	2.00E-01	8.42E-05	No
Mercuric Chloride	3.33E-04	**6.82E0**	6.76E-05	2.94E-04	5.04E-05	1.83E-05	2.49E-05	1.61E-04	Yes
Methyl Mercury	6.20E-01	8.68E-01	3.03E-03	1.67E-02	1.49E-02	1.18E-02	2.38E-02	8.79E-01	No
Nitrobenzene	2.59E-09	4.79E-08							No
Pentachlorophenol	1.06E-05	4.07E-04	1.87E-07	3.43E-03	1.72E-03	1.10E-08	7.38E-05	2.49E-06	No
2,3,7,8-TCDD		6.58E-01	5.37E-06	**1.52E+01**	**2.97E+01**	7.37E-07	4.40E-01	1.60E-05	Yes
Average risk emissions scenario									
Cyanide	1.92E-04		4.10E-09	6.30E-09	1.14E-06	1.61E-06	1.45E-06	9.00E-03	No
2,3,7,8-TCDD		**4.06E+01**	3.30E-04	**9.38E+02**	**1.80E+03**	4.54E-05	**2.71E+01**	9.87E-04	Yes

FW: Communities Inhabiting Fresh Water. SED: Communities Inhabiting Freshwater Sediment.
HM: Herbivorous Mammal. OM: Omnivorous Mammal. CM: Carnivorous Mammal.
HB: Herbivorous Bird. OB: Omnivorous Bird. CB: Carnivorous Shore Bird.
COPC: Retained as Contaminant of Potential Ecological Concern by SLERA.

Table 2.5-1. Comparisons of soil metal concentrations against background threshold values Box Elder Wash

Analyte	Concentration in surface soil at Box Elder Wash	Background threshold concentration (mean + 2x standard deviation)
Aluminum	11,000	23,765
Antimony	1.6	7.14
Arsenic	5.5	31.9
Beryllium	0.51	2.20
Cadmium	0.62	0.847
Chromium	13	26.4
Copper	14	32.6
Cyanide	0.59	0.92
Lead	11	75.2
Nickel	14	29.5
Selenium	**0.59**	0.25
Silver	**1.2**	0.660
Thallium	1.2	23.7
Zinc	53	140.8

All data are in mg/kg. Bolded values exceed the corresponding soil background threshold value.

Uncertainty Discussion: Several uncertainties underlie the use of the ESQs presented in Tables 2.4-1 through 2.4-5 to evaluate the potential for risk to ecological receptors caused by emissions from the operation of the OB/OD Unit at TEAD. Some of the most important uncertainties include:

1. Uncertainties in the dispersion modeling performed using EcoRiskView to estimate concentrations in soils at Locations 1 and 2 and surface water and sediment at Locations 4 and 5,

2. Representativeness of the soil samples (and for the uncertainty Risk scenario the potential for ESQ values greater than 1.0 for some COPECs that were not detected but evaluated based on MQL-derived concentrations) collected at Box Elder Wash (Location 3) for laboratory analysis,

3. Uncertainties in the ingestion rates presented in Table 2.2-1 (including the fact that the ingestion rates are based on single species representative of each functional feeding guild and not on every species potentially affected),

4. Uncertainties in the factors used by EcoRiskView to estimate concentrations in the food chain (termed bioconcentration factors, and presented in Appendix C of EPA, August 1999), and

5. Uncertainties inherent in the TRVs.

One key source of uncertainty is the fact that TRVs are not available for every chemical analyte for every assessment endpoint evaluated in the SLERA. Chemical analytes for which no TRVs are available for any of the assessment endpoints include:

- Benzene
- Carbon tetrachloride
- Chlorine
- Chloroethane
- Diethylphthalate
- Ethylbenzene
- Hydrogen chloride
- Methyl chloride
- Methylene chloride
- Styrene
- PCE
- Toluene
- 1,3,5-Trinitrobenzene
- 2,4,6-Trinitrotoluene

Most of the chemical analytes lacking TRVs are organic compounds for which there are few or no reliable toxicological investigations reported in the scientific literature. The SLERA can not reliably indicate whether these chemical analytes do or do not pose a potential ecological risk.

3. RERERENCEES

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APPENDICES

APPENDIX 2.4-A

ECORISK FILES

Eco-Risk Project Files and Methods

The Box Elder Wash scenario was evaluated as a separate project from the scenarios to be modeled based on air modeling since EcoRisk View does not have the capability to perform risk assessments on prescribed media and modeled air data concurrently. Food webs for all four scenarios were created to mask the requirements of the December 27 memorandum that concerned the ecological risk assessment with the exception of the following changes:

1. The omnivorous organisms were changed to consume only plant matter and invertebrates.
2. Carnivorous organisms were changed to eat both second and third trophic level organisms. Mink had fish added to its list of prey consumed.

In addition, chromium soil concentrations and air emissions were entered as both chromium (III) and chromium (VI) where applicable. This performed the risk assessment as if all of the chromium present is present in both forms.

Descriptions of the EcoRisk View projects created as well as the format of the results are provided below.

Box Elder Wash

A new project (entitled Box Elder Wash) was created in EcoRisk View using the option to perform the risk assessment based on prescribed media concentrations, and the domain of the project was set to include Rush Lake, Tooele Army Depot (TEAD), and Grantsville Reservoir and its watershed. Although the location of the Box Elder Wash would have no effect on the results of the risk assessment, it was placed at the UTM coordinates of the maximum onsite location (Table G) based on air modeling. A soil polygon was drawn surrounding that location of the Box Elder Wash, and the measured soil concentrations (Table M) were entered as occurring in that soil polygon. An upland food web was created to mask the requirements of the December 27 memorandum that concerned the ecological risk assessments with the exception of

the changes mentioned above. Site-specific parameters were assigned to the risk assessment as spelled out in the information provided by Tetra Tech NUS. The results of the risk assessment were exported to Microsoft Access for post-processing prior to being sent to Tetra Tech NUS.

Air Modeled Receptors

The four air modeled receptor locations were the maximum on site location based on air modeling, the maximum off site location based on air modeling, Rush Lake, and Grantsville Reservoir. Prior to creating an EcoRisk project, air modeling files were created for all of the sources to be evaluated (OB, OD, SF, and TEAD). The OB, OD, and SF sources had different emissions scenarios based on the risk that they would estimate, average risk, uncertainty risk, and primary risk. The maximum risk scenario was not evaluated in the ecological risk assessment because acute air modeling is not supported in EcoRisk. TEAD had only one set of emissions data. The naming convention was based on the source followed by the type of risk that was being estimated. For example, OBAR designates the OB source average risk and SFUR designates the SF source uncertainty risk. TEAD was renamed to DF for the purpose of nomenclature, and because it only has one set of emissions data, all TEAD modeling and evaluation was performed under the name of DFMR. This created an end result of 10 air modeling files.

A new project (entitled Air Modeled Receptors) was created in EcoRisk using the option to perform the risk assessment based on air modeling, and the domain of the project was set to include Rush Lake, TEAD, and Grantsville Reservoir and its watershed. The first task accomplished was to create the water bodies and watersheds for Rush Lake and Grantsville Reservoir. The four food webs were then created. Two freshwater food webs were created, one in the location of Rush Lake and the other in the location of Grantsville Reservoir. The other two food webs were upland food webs, one at the maximum on site location based on air modeling and the other at the maximum off site location based on air modeling. Since EcoRisk requires that each food web be assigned to a watershed and Waterbody, two food webs were created for each location, one using each water body and watershed (Rush Lake and Grantsville

Reservoir and their associated watersheds). This created a total of four upland food webs. Site-specific parameters were assigned to the risk assessment as spelled out in the information provided by Tetra Tech NUS. The results of the risk assessment were exported to Microsoft Access for post-processing prior to being sent to Tetra Tech NUS.

Results

The current EcoRisk version used does not calculate the risk to communities, so these values were calculated using Excel. Only two community ESQs were calculated for the freshwater food webs because the only TRVs available are sediment TRVs and a generic freshwater TRV. The results for risk to the communities was appended to the results calculated by EcoRisk View. The resulting data were exported from Access into two separate files: "Air Modeled Eco Results.csv" and "Box Elder Soil Eco Results.csv." Another file was created in Access that created on results file (Eco Results.pdf).

Project Files require EcoRisk software to open.

Each sub-project is designed to include results specific to an emission scenario. These include the following:

Dfaa - DF
pr - Primary
ar - average
ur - uncertainty
max_acute - OB/OD/SF max acute

pr - Primary
ar - average
ur - uncertainty

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